Modifying Single Layer Graphene with Aryl Diazonium Salts

Anna K. Farquhar, Paula A. Brooksby, Alison J. Downard

MacDiarmid Institute for Advanced Materials and Nanotechnology, Department of Chemistry, University of Canterbury, Christchurch

Email: anna.farquhar@pg.canterbury.ac.nz

1. Making workable devices from graphene

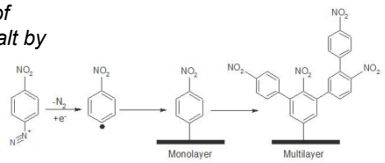
Graphene is difficult to handle:

- Tendency to aggregate
- Limited reactivity

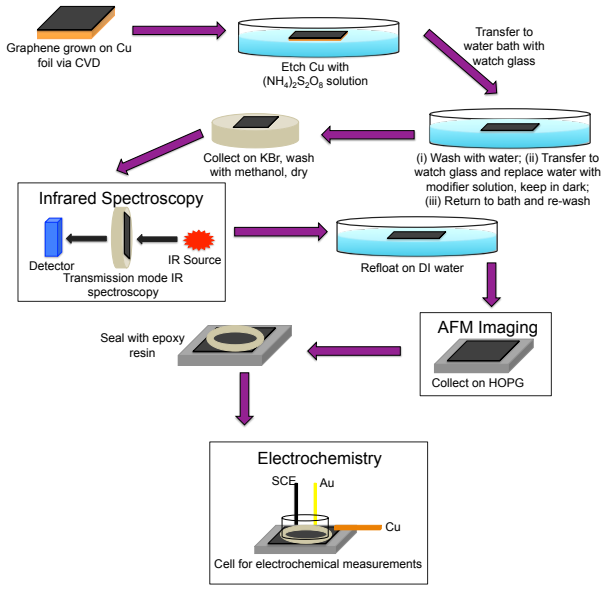
Chemical modification improves handling and introduces functionality

A promising method is the addition of aryl diazonium salts

"Spontaneous" reduction of nitrobenzene diazonium salt by graphene

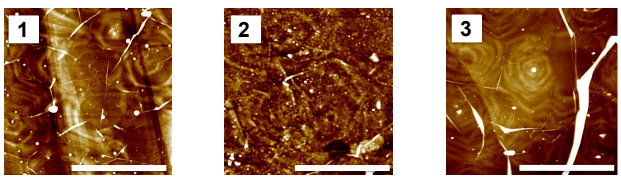


2. New method for sample handling



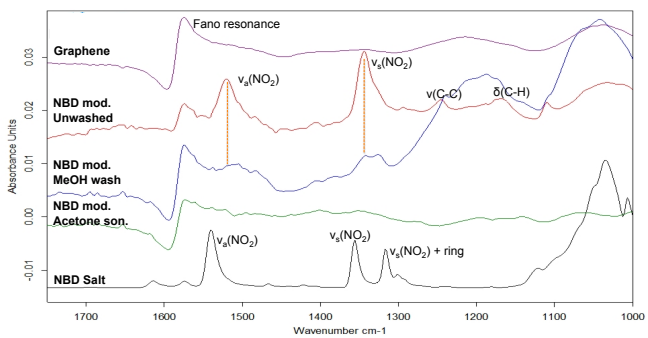
3. Modification with nitrophenyl (NP) groups

AFM images before and after modification:

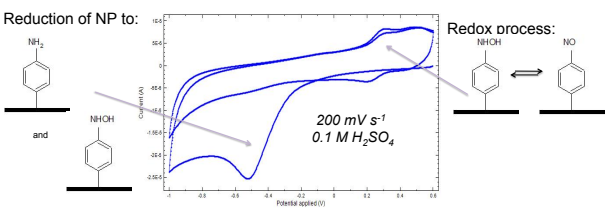


1. Graphene; 2. Graphene surface with NP groups, methanol wash; 3. Graphene surface with NP groups, after acetone sonication. Scale bar 2.5 μm.

IR spectroscopy before and after modification:

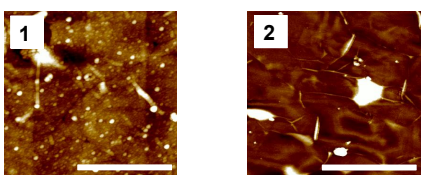


Electrochemistry after modification:

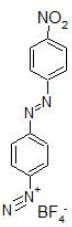


4. Modification with nitroazobenzene (NAB)

AFM images after modification:

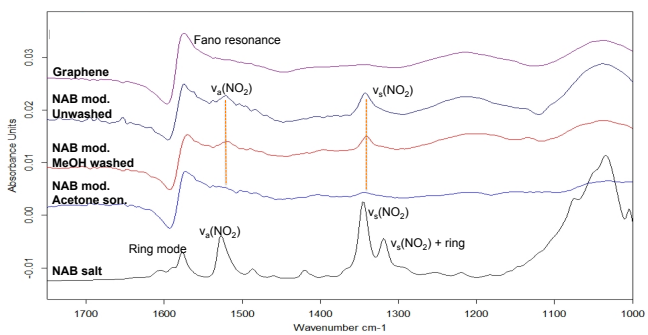


1. NAB modified graphene, methanol wash only; 2. NAB modified graphene, after acetone sonication. Scale bar 2.5 μm

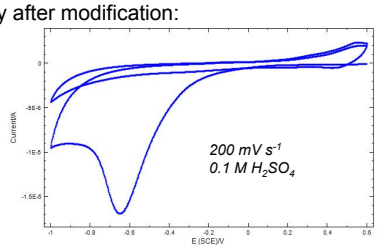


NAB diazonium salt

IR spectroscopy before and after modification:



Electrochemistry after modification:



5. Conclusions and future work

- A new technique has been developed to modify and analyse free-floating graphene
- For both modifiers a film is formed at the surface
- Methanol washing and acetone sonication remove some material from the surface
- To date, it is not known if the film is covalently bound to surface
- Future work will:
  - use STM to investigate covalent bonding
  - explore other covalent modification methods

Geng, D.; Luo, B.; Xu, J.; Guo, Y.; Wu, B.; Hu, W.; Liu, Y.; Yu, G., Self-Aligned Single-Crystal Graphene Grains. Adv. Funct. Mater. ***2014,*** *24 (12), 1664-1670.*

Chua, C. K.; Pumera, M., Covalent chemistry on graphene. Chem. Soc. Rev. ***2013,*** *42 (8), 3222-3233.*

UNIVERSITY OF CANTERBURY Te Whare Wānanga o Waitaha CHRISTCHURCH NEW ZEALAND

The MacDiarmid Institute for Advanced Materials and Nanotechnology

MARSDEN FUND

TE PŪTEA RANGAHAU A MARSDEN